

WE CLAIM:

- 5 1. An optical polarizer, comprising:
a polymeric reflective polarizer including a first and second
polymeric material, at least one of the first and second polymeric material being
birefringent such that a refractive index difference between the first and second
polymeric material for light having a first polarization state is large enough to
substantially reflect the light having the first polarization state and a refractive index
10 difference between the first and second polymeric material for light having a second
polarization state is small enough to substantially transmit the light having the
second polarization state; and
an absorbing polarizer disposed in close proximity to the polymeric
reflective polarizer and aligned to absorb light of the first polarization state and to
reflect light of the second polarization state, the absorbing polarizer directly
15 receiving light which is not reflected by the polymeric reflective polarizer.
- 20 2. An optical polarizer as recited in claim 2, wherein the absorbing
polarizer is formed integral with the polymeric reflective polarizer.
- 25 3. An optical polarizer as recited in claim 3, comprising a multilayer
stack of alternating layers of the first and second polymeric material forming the
reflective polarizer and a polymeric layer of material mixed with a dichroic dye
forming the absorbing polarizer.
4. An optical polarizer as recited in claim 3, wherein the layer forming
the absorbing polarizer is coextruded with the polymeric material of the reflective
polarizer.
5. An optical polarizer as recited in claim 4, wherein the absorbing
polarizer comprises a polymeric layer of material mixed with a dichroic dye.

6. An optical polarizer as recited in claim 5, wherein the polymeric layer of material mixed with a dichroic dye is laminated to the reflective polarizer.

7. An optical polarizer as recited in claim 5, wherein the polymeric layer of material mixed with a dichroic dye is coextruded with the first and second polymeric material of the reflective polarizer.

8. An optical polarizer as recited in claim 1, wherein the absorbing polarizer is bonded to the polymeric reflective polarizer.

9. An optical polarizer as recited in claim 8, wherein the absorbing polarizer is laminated to the polymeric reflective polarizer.

10. An optical polarizer as recited in claim 1, wherein the polymeric reflective polarizer comprises a multilayer optical stack including alternating layers of the first and second polymeric material.

11. An optical polarizer as recited in claim 10, wherein the absorbing polarizer is distributed within individual layers within the multilayer optical stack with a higher concentration in regions of one of a maximum or minimum E field intensity within the multilayer optical stack.

12. An optical polarizer as recited in claim 1, wherein the refractive index difference between the first and second polymeric material for light having the first polarization state is aligned along a first in-plane axis of the reflective polarizer and the refractive index difference between the first and second polymeric material for light having the second polarization state is aligned along a second in-plane axis of the reflective polarizer.

13. The optical polarizer of claim 1, wherein the dichroic polarizer is positioned to provide antireflection on at least one side of the reflective polarizer.

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14. The optical polarizer of claim 1 wherein the dichroic polarizer is bonded to the reflective polarizer.

5 15. The optical polarizer of claim 10 wherein at least two adjacent layers in the reflective polarizer exhibit a refractive index difference between layers along at least one in-plane axis that is greater than a refractive index difference between layers along an out-of-plane axis.

10 16. The optical polarizer of claim 1 wherein the first material is a naphthalene dicarboxylic acid polyester.

15 17. The optical polarizer of claim 1 wherein the reflective polarizer is planar.

18. The optical polarizer of claim 10 wherein the multilayer stack is oriented along a first in-plane axis.

20 19. The optical polarizer of claim 12 wherein the refractive index difference along the first in-plane axis is at least 0.05.

20. The optical polarizer of claim 12 wherein the refractive index difference along the first in-plane axis is greater than about 0.2.

25 21. The optical polarizer of claim 12 wherein the refractive index difference along the second in-plane axis is less than about 0.02.

30 22. The optical polarizer of claim 12 wherein a ratio of the refractive index difference along the second in-plane axis to the refractive index difference along the first in-plane axis is about 0.

23. The optical polarizer of claim 12 wherein a ratio of the refractive index difference along the second in-plane axis to the refractive index difference along the first in-plane axis is between 0.0-0.5.

5 24. The optical polarizer of claim 15 wherein a ratio of the refractive index difference along the out-of-plane axis to the refractive index difference along the first in-plane axis is about 0.

10 25. The optical polarizer of claim 15 wherein a ratio of the refractive index difference along the out-of-plane axis to the refractive index difference along the first in-plane axis is less than about 0.1.

15 26. The optical polarizer of claim 15 wherein a ratio of the refractive index difference along the out-of-plane axis to the refractive index difference along the first in-plane axis is between 0.0-0.5.

20 27. The optical polarizer of claim 15 wherein an absolute value of the refractive index difference along the second in-plane axis is greater than zero when an absolute value of the refractive index difference along the out-of-plane axis is greater than zero.

25 28. The optical polarizer of claim 27 wherein the refractive index difference along the second in-plane axis is greater than the refractive index difference along the third out-of-plane axis.

29. The optical polarizer of claim 27 wherein the refractive index difference along the second in-plane axis is of the same sign as the refractive index difference along the third out-of-plane axis.

30. The optical polarizer of claim 27 wherein the refractive index difference along the second in-plane axis and the refractive index difference along the third out-of-plane axis are positive.

5 31. The optical polarizer of claim 27 wherein the refractive index difference along the second in-plane axis and the refractive index difference along the third out-of-plane axis are negative.

10 32. The optical polarizer of claim 1 wherein the reflective polarizer has no Brewster angle.

15 33. The optical polarizer of claim 15 wherein the refractive index difference along the third out-of-plane axis is such that the reflective polarizer has no Brewster angle.

34. The optical polarizer of claim 15 wherein the refractive index difference along the third out-of-plane axis and the refractive index difference along the second in-plane axis are such that the reflective polarizer has a Brewster angle between 0-30 degrees.

20 35. The optical polarizer of claim 15 wherein the refractive index difference along the out-of-plane axis and the refractive index difference along the second in-plane axis are such that the reflective polarizer has a Brewster angle of between 30-60 degrees.

25 36. The optical polarizer of claim 15 wherein the refractive index difference along the out-of-plane axis and the refractive index difference along the second in-plane axis are such that the reflective polarizer has a Brewster angle of greater than 60 degrees.

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37. The optical polarizer of claim 15 wherein the refractive index difference along the out-of-plane axis is less than about 0.11.

38. The optical polarizer of claim 37 wherein the refractive index difference along the out-of-plane axis is less than about 0.05.

39. The optical polarizer of claim 38 wherein the refractive index difference along the out-of-plane axis is less than about 0.01.

40. The optical polarizer of claim 39 wherein the refractive index difference along the out-of-plane axis is about 0.

41. The optical polarizer of claim 21 wherein the refractive index difference along the second in-plane axis is less than about 0.01.

42. The optical polarizer of claim 41 wherein the refractive index difference along the second in-plane axis is about 0.

43. A display device, comprising:
a light modulator provided to selectively alter a polarization state of light incident on the light modulator; and
a reflective-dichroic polarizer disposed adjacent the light modulator, the selective-dichroic polarizer comprising:

a reflective polarizer including a first and second polymeric material having a refractive index difference large enough along a first axis to substantially transmit light of a first polarization, and having a refractive index difference along a second axis which is small enough to substantially reflect light of a different polarization; and

a dichroic polarizer disposed in close proximity to the reflective polarizer.

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Claims 1-42
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